CONCERNING ASCENDING RENAL TUBERCULOSIS.[1]

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There is almost a consensus of opinion today regardiug the preponderanee of the ineidenee of primary renal tubereulosis, with seeondary deseending infeetion of the ureter and bladder, authentie eases of primary involvement of the distal portions of the urinary tract being relatively rare. Some authors dispute the validity of the arguments of those who believe that ascending infeetion of the ureter and kidney can occur. It is our purpose in this paper to present some of our own clinical and pathological observations, as well as eystoseopie findings, that support strongly the contention of those who, admitting the rarity of the *ascending modus* of infection, still believe that it may obtain in a small percentage of the cases.

Experimentally a number of authors, among whom may be mentioned Albarran, Bernard and Wildboldz, have proved the possibility of producing a tuberculous infection of the kidney by way of the ureter. In order to bring about this result, however, a complex of conditions has to be complied with, such as can rarely be realized clinically. Bauereisen, basing his conclusions upon very thorough and experimental researches, contends that an ascending lymphogenic infection of the wall of the ureter is possible. However, the proofs submitted by authors of this school are not sufficiently convincing to be accepted.

In conflict with the views of the partisans of the "ascending modus" of infection may be cited anatomical findings in the kidney that refute seemingly strong evidences of primary bladder involvement. Thus profound vesical ulcerations and lesions, marked involvement of the lower ureter, with ulcerative and massive cheesy infiltration, associated with a dilated ureter above, but with very superficial changes—all these, although speaking in favor of a primary vesical tuberculosis, with ascending process, involving, first, the lower ureter, and then to a lesser degree the upper—can, in no sense, be accepted as proving the *ascending theory*, since it inevitably will be found that in practically all the cases described *old lesions of the corresponding kidney already exist.* It is therefore with considerable truth that Halle and Motz reply to the sponsors of the ascending theory. "We have still to find profound ureteral ostial lesions at the bladder, with complete integrity of the corresponding kidney."

[1] Read before the Genito-urinary Section, New York Academy of Medicine, May 21, 1919.

In short, whenever a kidney shows extensive or old lesions the mere finding of more extensive ulcerations in the inferior or distal ureter, or more extensive pathological destruction in the lower ureter than in the upper, cannot be regarded as offering testimony in favor of the ascending theory, since we know only too well that dependent portions, such as the lower ureter, may, by reason of the accumulation of tubercle bacilli and tuberculous products, and by virtue of the stagnation that can occur at this point, evidence alterations of greater extent than portions of the tract that have been involved for even greater periods of time.

There are, however, a number of reported cases in the literature that are in keeping with the cases that we shall report in this paper and that give more reliable and more conclusive evidence in favor of the validity of the ascending theory and which demonstrate that this modus of infection may obtain. Thus Wildbold reports the following case: The bladder, ureter and pelvis of the kidney tuberculous, *without any lesion in the parenchyma of the kidney.*

Hottinger cites the following case: Extensive involvement of the bladder and prostate; left ureter involved only at its inferior extremity, with the pelvis and the kidney itself healthy.

Although these cases definitely prove the possibility of the occurrence of ascending infection, the paucity of such observations testifies also to the rarity of this modus of infection.

As for the clinical observations that speak in favor of ascending infection, there are a number of types which could be mentioned. Probably most numerous are those cases in which the healthy sister organ becomes infected by the ascending route, the other kidney, ureter and bladder having been previously involved.

More rarely we may assume that reflux of urine into the ureter may obtain—this possibility being demonstrated clinically and pathologically—the involvement of the ureter then being secondary to a bladder infection, which in turn may supervene after a primary involvement of the prostate and testicles.

And then it is well known there are cases of congenital dilatation of the whole urinary apparatus in which cystoscopy demonstrates dilated and very much enlarged ureteral orifices and in which cystography, combined with ureterography and pyelography, have shown the existence of patency of the ureters and their wide communications with the bladder. In such cases not only are anatomical conditions given for the occurrence of ascending infection, but my own observations have proved to me that secondary ureteral and renal pelvic tuberculosis can occur.

Other clinical testimony in favor of the occurrence of the ascending infection is recorded by Rovsing, who described at the First International Congress of Urology six cases in which he had found dilatation of the ureter and pelvis of the kidney above a tuberculous stenosis of the lower end of the ureter, with progressive develop-

ment of lesions *from below upward*. In his cases the cause of the ureteral stricture varied, the primary focus being situated in the prostate, with secondary involvement of the bladder, and then the ureter.

According to some authors, among whom may be mentioned Rafin, the view is expressed that clinically tuberculosis of the bladder does not exist except in connection with renal tuberculosis. My own clinical observations, however, have demonstrated to me that we must accept the possibility of the incidence of primary tuberculosis of the bladder, although the integrity of both kidneys is difficult to prove in those cases in which exploratory operation has not been performed, and although the number of cases in which nephrectomy was done and in which the ascending modus seems to be definitely shown is a small one.

In short, from the literature one would say that the results of animal experimentation, studies of pathological specimens and investigations along clinical lines offer indisputable evidence that the ascending modus of infection may obtain, although when the cases are carefully analyzed and compared with the numbers belonging to the descending class their paucity and rarity is astonishing, to say the least.

It may be well, therefore, to add several cases from my own case records, which cast some doubt on the general dictum, so widely accepted today, that a tuberculous bladder means a primary tuberculous kidney—cases that present, furthermore, points of diagnostic interest as well as valuable hints as to prognosis.

Certain cases have come under my observation that offer clinical and pathological evidence in favor of the assumption that *ascending infection* of the urinary tract with tubercle bacilli does occur.

The observations to be cited may be of some clinical as well as pathological interest, for they concern patients that evince the seemingly paradoxical phenomenon of a clinical cure or at least marked improvement of what *appears to be* the *primary* tuberculous focus when the secondary focus is removed. By this we mean that in two of our cases that presented marked bladder symptoms, with superficial tuberculous ulcerations, marked ureteral tuberculosis and infection of one kidney, either the pelvis alone being involved or associated with a minute parenchymal focus—most remarkable amelioration of the vesical lesions occurred after nephrectomy. So that after the removal of what appeared to be the secondarily involved renal focus the bladder symptoms disappeared completely, and even tubercle bacilli, whose presence had been demonstrated on several occasions before operation, could not be found several months after nephrectomy had been done.

This would appear to cast some doubt on the validity of the assumption that the bladder or some distant urinary part was primarily involved, but the pathological findings, as well as some of

the clinical observations, speak against this view, as will be seen by a close study of the history and the results of examination.

We must then assume that in our cases of ascending urinary tuberculosis the bladder could not take care of itself by reason of the fact that the ureter had been extensively involved and that possibly a small focus, secondarily produced in the kidney, was sufficiently large to form a storehouse for the accumulation and further propagation and distribution of the tubercle bacilli.

Let us briefly summarize some of the views regarding the inception of a tuberculous process in the urinary tract, alluding first to what is known as "the theory of primary invasion of the cortex of the kidney."

According to the views of some authors, among whom can be mentioned Koenig and Pels-Leusden, chronic tuberculosis of the kidney begins, in the majority of cases, with the formation of small cortical miliary tubercles that multiply, extend into the medulla and finally perforate into the pelvis of the kidney. The solitary or multiple tubercles that appear in the renal cortex early in the development of renal tuberculosis have no relation to the renal calyces or pelvis. Such foci may remain in the kidney for years without causing the appearance of tubercle bacilli in the urine.

More recent observations and studies, however, have demonstrated *this latter view to be incorrect.* In fact it has been shown that such tubercles are merely acute or subacute miliary tubercles of the kidney, that may arise shortly before death and whose further development is arrested by the death of the patient. In fact, most of the recent observations have definitely proved that chronic renal tuberculosis has its inception *most frequently* in the medulla, in some cases in the boundary zone between cortex and medulla and in other cases in the renal papillæ. Those foci which develop in the medulla seem to emanate from lesions of one papilla or in the transitional region between the calyx and papilla, often in the recesses of the calyx.

According to Wildbolds the following may be regarded as the first stages in the development of tuberculosis of the kidney.

In a kidney that is externally practically normal, with or without a small group of tubercles in the cortical zone corresponding to the site of the lesions, we see on cross-section of the organ a practically normal surface except for the changes in one or more papillæ. Thus in one or more papillæ, possibly some distance from each other, there develop smaller or larger yellowish nodules, with coagulation necrosis or breaking down in the direction of the renal pelvis, with the formation of an ulcer. Sometimes it is only the tip of a papilla that is involved, while at other times there may be merely a suggestion of a lesion at the tip of the papilla in the form of swelling, unusual pallor of the papilla, with a peculiar glossy alteration of the tissues. In other cases there may be found in a niche or recess of

the minor calyces an ulcer that lies partly in the calyx wall and partly over the margin or surface of the papilla. In later development we may find minute miliary tubercles arranged in a radiate manner in the pyramids corresponding to the involved papillæ.

On microscopic section we find miliary tubercles, with miliary or conglomerate agminated tubercles and some coagulation necrosis surrounded by a reactionary zone of lymphocytes, that usually extends toward the pelvis, where necrosis of the epithelium has taken place, with the formation of a cheesy ulcer.

It is from these small beginnings, the primary foci in the kidney itself, that we get all those vast destructive lesions in the kidney that are known so well—namely, the formation of tuberculous cavities; the conversion of the kidney into a tuberculous pyonephrosis; the secondary involvement of the renal pelvis, with miliary tubercles, conglomerate tubercles, cheesy deposits, indurated lesions, stenotic lesions, with retention of urine and inflammatory products in the pelvis of the kidney; the changes in the ureter; the secondary involvement of the bladder and of the distal urinary and sexual organs.

With these generally accepted views as to pathology in mind, the arguments in favor of the ascending theory offered by our cases may be better appreciated.

The following cases from my files are interesting examples of ascending renal tuberculous infection.

CASE I.—*Tuberculosis of the bladder; tuberculosis of the right ureter; minimal changes in the right kidney; tubercle bacilli obtained from the bladder and right kidney; vesical symptoms and tubercle bacilli disappear from the urine after nephrectomy.*

F. S., female, aged fifty-seven years, mother of eight children, consulted me on April 29, 1918, with the complaint that micturition was painful and very frequent, there being almost a constant desire to void.

These symptoms, the urgency, the pain on urination and the voiding in small quantities frequently, had been present for about four months. For the last four days blood had been present in the urine. There had been no noticeable loss in weight and no symptoms referable to the kidney other than an occasional ache in both lumbar regions, not partaking of the nature of renal colic and ill-defined in localization. Lately she has been voiding twice at night, and when in the direct posture she has almost a constant desire to void.

Cystoscopy (April 29, 1918). Examination of the bladder shows an irregularly shaped ulcer over the anterior wall not far from the sphincter, surrounded by inflamed mucous membrane. In this neighborhood there are a few follicles, suggestive rather of follicular cystitis than tuberculosis. Throughout the bladder there are

patebes suggestive of cystitis en plaque, neither orifice sbowing anything suspicious of tuberculosis.

Both ureters were catheterized, tbe urine being almost clear from both sides, the rigbt containing red blood cells but no pus.

Examination of the separated urinary specimens of tbe rigbt and left kidney and bladder for tubercle bacilli showed the presence of tubercle bacilli in the bladder, and none in either the right ureter, right kidney or left kidney specimen.

In short, in this case the first cystoscopy suggested an ulcerative cystitis, with lesions very near the sphincter, over the roof of the bladder and anterior wall, because of the presence of an irregularly shaped superficial ulcer, together with the pateby cystitis.

Therefore, symptoms suggestive of a possible tuberculous ulcerative condition, with nothing strongly suspicious of primary involvement of either kidney, but with the finding of tubercle bacilli in the bladder specimen.

Cystoscopy (May 2, 1918). At this second examination both urcters were again catheterized, tbe specimens from the right side containing some blood, the specimen from the left kidney being negative. *Tubercle bacilli were present in the right kidney and bladder specimens.* The rigbt ureteral orifice was seen to be somewhat irregular in shape, somewhat crenated, pus being absent in thc renal specimens, although tubercle bacilli were found in the rigbt kidncy specimen.

In view of the absence of pus in the right kidncy specimen, the negative lcft kidney specimen, tbe discrepancy between thc meager findings in the right kidney, the extensive lesions in the bladder and the finding of tubercle bacilli, it was decmed advisable to do a third cystoscopy in order to obtain further light as to whether the right kidney was involved or not. It may be said that in order to prevent regurgitation of fluid from the bladder into either kidney specimen obtained through the ureteral catheter, it is always my practice to empty tbe bladder first thoroughly through the cystoscope while specimens are being collected from the kidney. Reflux or regurgitation backward into the ureters, therefore, could be ruled out as a factor in determining the presence of tubercle bacilli in either kidney specimen.

Cystoscopy (May 6, 1918). A third examination, therefore, was deemed advisable, since the role played by the rigbt kidney in the pathological process at hand was not clear. It was decided therefore to collect at least four separate specimens from the right kidney during five-minute periods each, with the catheter in the pelvis of the kidney, in order to be absolutely certain as to the involvement of the right renal organ.

The report on the separated urinary specimens thus collected showed the *absence of tubercle bacilli* in all tbe left specimens, the presence of tubercle bacilli in the bladder and the presence of

tubercle bacilli in the second, third and fourth right kidney specimens, approximately collected during the second, third and fourth period of five minutes each, the first specimen having been discarded, inasmuch as contamination, due to the passage of the ureteral catheters through the bladder, must be ruled out in all such examinations.

In short, *in a case giving the typical bladder symptoms of renal and vesical tuberculosis, with superficial ulcerations in the bladder, with tubercle bacilli in the bladder urine, with an apparently normal left kidney,* and *with tubercle bacilli in the right kidney specimens on three different occasions, we were confronted with tuberculous lesions of the bladder, probably also of the right ureter and right kidney.* Cystoscopic findings spoke strongly against any marked involvement of the integrity of the right kidney, inasmuch as its functional activity was good and pus cells could not be obtained at any time from the pelvis of the right kidney itself.

Inasmuch as bladder irrigations that had already been tried before the patient had consulted me, and were again carried out under my supervision for a period of some two weeks, did not seem to ameliorate the condition, it was decided to do an exploratory operation upon the right kidney, in the hope that a primary focus could be found in this organ, although the urinary evidences were doubtful.

May 15, the right renal nephrectomy was easily carried out and a small organ, showing on its external surface no evidences of tuberculosis, was removed, in view of the fact that the ureter was thickened, particularly in its lower portion, the changes in it being sufficient to warrant the assumption that it was involved in a tuberculous process. Whether in the ascending or descending sense could not be determined.

The specimen when bisected seemed at first sight to be that of a perfectly healthy organ, but on closer inspection it was seen that there were at least three tuberculous foci of very small extent in the parenchyma. One of these, evidently a focus that in no way communicated with the pelvis, was about 3 to 4 mm. in diameter and suggested strongly confluent miliary tubercles and two additional smaller miliary tubercles were found in the cortex in a situation corresponding to that of the larger lesion. There were no ulcerations at the tips of the papillæ, but one suspicious minute tuberculous focus in one of the recesses of a calyx, which on microscopic examination was found to be a miliary tubercle of considerable size that had not as yet undergone cheesy degeneration and involved a calyx in one of its recesses, the section being very difficult to find, necessitating a large number of microscopic sections.

In short, there was no lesion macroscopically indicative of primary involvement of the kidney, but miliary tubercles without cheesy degeneration and not communicating directly with the pelvis.

The small size of the lesion, the absence of necrosis and absence of direct pelvic communication rule this out as being responsible for the lesions lower down in the urinary tract and for the presence of tubercle bacilli in the urine.

The pelvis showed a few scattered tubercles, while the ureter showed many more tubercles than the pelvis, their numbers becoming greater as the lower portion of the ureter was examined.

In brief, minimal secondary lesions in the kidney, few miliary tubercles in the pelvis, numerous tubercles in the ureter, with some areas of superficial ulceration and extensive lesions in the bladder.

These findings, it appears to me, are sufficiently characteristic to warrant the assumption that we were dealing here with a tuberculous process that had secondarily involved the kidney and the ureter, the most marked lesions being present in the bladder.

Subsequent Clinical Course. The patient made an uneventful recovery after nephrectomy, but the bladder symptoms persisted for some time. No treatment was prescribed for the bladder, as it was doubtful as to whether complete restitution to normal could take place, in view of the fact that the lesions of the kidney could hardly be held responsible for the lesions in the bladder.

During the summer of 1918 gradual improvement occurred, although a moderate amount of pollakiuria was still noted in September.

In October, 1918, she felt considerably improved and a cystoscopic examination was made on October 22. The ulcers had completely disappeared, the bladder showing marked improvement. The only lesions that could be detected were a moderate degree of redness, patches over the anterior wall near the sphincter, some follicular cystitis, the ureteral orifices being normal. *In short, disappearance of the ulcers and marked improvement.* October 23, *examination of the bladder urine failed to show the presence of tubercle bacilli.* Since then tubercle bacilli have been absent, and the patient in April, 1919, reports that she is practically well. Cystoscopy May 8, 1919, showed a bladder that could be regarded as almost normal.

Epicrisis. Enough data have been adduced in this case to strongly support the view that the involvement of the kidney was secondary to a process lower down in the urinary tract. Whether the renal lesions are secondary embolic invasions through the blood stream or in the true ascending sense cannot be determined. Certain it is, however, that they are of more recent date than the bladder lesions. What, however, is not so clear is how the nephrectomy could possibly have influenced the vesical process so rapidly, not only in contributing to the disappearance of the ulcers, but also in causing the absence of tubercle bacilli in the urine. Perhaps the following is the explanation. That by reason of the tuberculous

involvement of the distal part of the ureter and the marked relaxation and insufficiency of the vesical orifice a certain amount of reflux regularly occurs—that stagnation in the ureter follows—so that tubercle bacilli are present in the pelvis rather by virtue of reflux than either by secretion through the kidney or by reason of the breaking down of the tuberculous focus in the kidney itself. This would explain the finding of tubercle bacilli in all the specimens obtained from the kidney even though collected over a long period of time (twenty-five minutes), the lesions of the parenchyma of the kidney being too minute to warrant the belief that tuberculuria could possibly be due to their presence. With the removal of the kidney and a large portion of the ureter a closed focus or pouch in which tubercle bacilli could be secreted and retained was eliminated and the bladder then was able to take care of itself. It is only in this way that we can explain the paradoxical result that followed the removal of a kidney with such insignificant minute minimal lesions.

The second case to be cited was even more striking in its offering of pathological evidence, that ascending tuberculosis of the urinary tract occurred. A kidney obtained at nephrectomy was slightly hydronephrotic, the pelvis showing extensive miliary tuberculosis, the parenchyma of the kidney being free except for a very few scattered miliary tubercles, these being visible after the capsule of the organ was stripped.

CASE II.—*Extensive ulcerative tuberculosis of the bladder; left-sided pyuria; tubercle bacilli in the specimens from the left kidney and also in the bladder, in a patient suffering from marked frequency of urination, dysuria, with occasional attacks of pain in the left hypochondriac region, nephrectomy showing a somewhat hydronephratic kidney with tuberculosis of the pelvis, the parenchyma being free except for a few miliary tubercles.*

A. E., female, aged sixty-seven years, consulted me on July 12, 1918, having been referred by Dr. P. Friedman, with the following history:

There had been attacks of pain in the left hypochondrium for about one year, the pain radiating to the left lumbar region and downward into the bladder; increasing urinary frequency, so that she frequently had incontinence during the day, voiding four to five times at night. Lately clots of blood had appeared in the urine.

Cystoscopy (July 12, 1918). Extensive ulcerations were found, and polypoid edema about the left ureteral orifice. The specimens from the right kidney were clear. Indigocarmin appeared in moderate concentration in the right kidney specimens. The left kidney specimens were cloudy, with a practically negative output of indigocarmin.

On microscopic examination numerous pus cells were found in the left kidney specimens, the right specimens being clear, tubercle bacilli being found in the left kidney specimen and bladder.

Tentative Diagnosis. Tuberculosis of the left kidney and bladder.

The patient refused operative intervention until September, 1918, when, in view of the persistence of symptoms, acquiescence was obtained.

Nephrectomy (September 20, 1918). Through the usual oblique incision (Albarran) a somewhat enlarged kidney was liberated from adhesions, the external surface evidencing no sign of tuberculous lesions. The pelvis, however, was markedly dilated (hydronephrotic), considerably thickened and evidently tubercuIous. The ureter was also found very much thickened; in its lower portion, selerotic and indurated; in its upper, dilated.

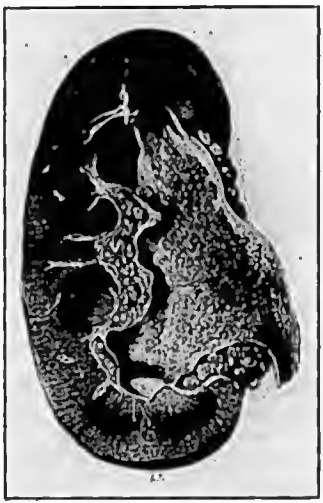

FIG. 1.—Renal pelvic tuberculosis showing an unusual type of ascending tuberculosis in which the pelvis was diffusely involved with miliary tubercles, the kidney being practically negative, except for a few small miliary tubercles seen in the upper pole and in the tissue of the mid-portion of the kidney.

The Pathological Specimen. On careful examination the kidney itself was found somewhat hydronephrotic, the extrarenal pelvis being particularly dilated. Careful examination of all the papillæ and the cortex *revealed absolutely no evidences of tuberculosis.* On stripping the capsule, however, a number of miliary tubercles, possibly seven or eight in all, were discovered, one of these showing tuberculosis on microscopic section.

The interior of the pelvis was diffusely tubercuIous, in places

showing discrete tubercles, but for the most part covered by myriads of tubercles fusing with each other (Fig. 1) and becoming more and more marked in the distal direction, the upper ureter region being extensively diseased, the ureter itself markedly thickened. The lower portion of the ureter showed marked indurative tuberculosis, with superficial tuberculous ulcerations.

In short, we have here a case in which the tuberculous lesions of the bladder were very marked, ulcers and polypoid edema being present, in which the ureter gave evidences of an extensive old tuberculous process, with some narrowing at its lower end, with consequent dilatation of the extrarenal pelvis, the latter showing extensive miliary tuberculosis. *The absence of tuberculous lesions in any of the papillæ, in the calyces and in the peripheral portions of the pelvis, the freedom of the renal parenchyma* (except for a few miliary tubercles) *seem to present sufficient evidence in favor of the assumption that here we were dealing with an ascending tuberculous process.*

The patient made an uneventful recovery after nephrectomy.

Future Course. The bladder symptoms rapidly disappeared, so that on May, 1919, the patient reported herself practically well.

While these two cases illustrate what we may regard as indisputable instances of ascending tuberculous infection, *there are certain other unusual cases of renal tuberculosis, that might be incorrectly assumed to belong to this class.* These are the cases in which the focus in the kidney is relatively minute, takes the form of a small ulcer of the pelvis, or of a calyx, or is represented by a cheesy plaque in one of the terminal recesses of a calyx wall. Be these lesions ever so small, however, they must be regarded as indicative of primary involvement of the kidney, for they never fail to show evidences of being of considerable age, are always disintegrated, cheesy foci from which the propagation of the tuberculous process downward takes place.

Thus in the following case to be cited, Fig. 2 shows an old and cheesy lesion of the mucosa of a calyx, while Fig. 3 is an example of a still older zone of coagulation necrosis of mucous membrane of a calyx in another case reported elsewhere by me.[2]

CASE III.—*Descending tuberculosis of the kidney simulating ascending tuberculosis; minimal renal lesions; practically intact renal parenchyma; minute lesions in calyces; diseased pelvis; extensive tuberculous ureteritis and cystitis.*

N. S., aged thirty-eight years, male, was admitted to the surgical service of the Mount Sinai Hospital, under my care, in July, 1917, with the usual symptoms characteristic of tuberculosis of the kidney and bladder—namely, frequency of urination, burning on urination, nocturia lasting for about six months and the passage of cloudy, purulent urine containing tubercle bacilli. On cystoscopic exami-

[2] New York Med. Jour., January 5, 1918.

nation, July 26, 1917, I found the usual lesions of tuberculosis in the bladder, polypoid edema about the right ureter and slight retraction in this region. Both kidneys functioned well, as evi-

FIG. 2.—Necrosis of mucosa of a calyx, the only tuberculous lesion found.

FIG. 3.—Coagulation necrosis of mucous membrane of a calyx (on the right).

denced by the output of indigocarmin, and a small number of white blood cells were found in the specimens obtained from both kidneys; but tubercle bacilli were found only in the specimens from the right kidney. A diagnosis of right renal and vesical tuberculosis was made.

On August 4, 1917, I did a typical nephrectomy, the following interesting lesions being encountered: The kidney was but slightly

FIG. 4.—Apparently intact kidney, with no gross surface lesions suggestive of tuberculosis, harboring small lesions in the calyces, and showing a thickened granular pelvis.

adherent, fairly movable, about normal in size, with no gross evidence of tuberculous involvement. The ureter was therefore palpated and was found densely adherent to the posterior parietes and surrounded by a mass of connective tissue, so firm in consistency that it appeared to be almost impossible of removal. With some difficulty a ureter as thick as a man's little finger was freed for a distance of about six inches, ligated and cut through, and the kidney was then removed.

It is the picture (Fig. 4) of this specimen of kidney pelvis and ureter with its seemingly normal parenchyma and its apparently extensive involvement of the pelvis of the kidney and ureter, that is worthy of consideration. This demonstrates the difficulty of macroscopic recognition of the lesions of renal tuberculosis.

On bisection of the kidney the only striking lesion that could be viewed with the naked eye was an intense inflammatory process involving the pelvis of the kidney and calyces, by virtue of which the pelvis was thickened to about three times the normal, its surface granular as if covered by a multitude of miliary tubercles, moderately reddened, but nowhere showing the lesions of tuberculosis, the small granules appearing much larger than those characteristic of miliary tuberculosis. No miliary tubercles could be seen in the parenchyma, nor were there any gross ulcerations of the apices of the papillæ. In short, macroscopically we had an apparently normal kidney with a very much thickened, inflamed and indurated pelvis and an enormously thickened ureter which, in a limited number of sections, showed nothing absolutely characteristic of tuberculosis.

It was not until a number of sections had been made through some of the hidden portions of the calyces, which had not appeared on bisection of the organ, that typical cheesy ulcerative lesions of tuberculosis were found. These involved a calyx without, however, showing any true miliary tubercles (Fig. 2).

These cheesy lesions should be regarded as absolutely characteristic of tuberculosis, when they are present in the kidney calyces, pelvis or ureter, and the diagnosis may be made even without the finding of endothelioid and giant cells. The photomicrograph represented in Fig. 2 shows a section through such a necrotic calyx. Above the mucous membrane is seen to be replaced by a zone of coagulation necrosis. The submucous connective tissue is markedly thickened by virtue of connective-tissue proliferation, and there are the cellular evidences of a chronic productive inflammatory process.

In a case of frank vesical tuberculosis, with tubercle bacilli in the urine and with typical lesions about the right ureteral orifice, we removed an enormously thickened ureter, doubtlessly tuberculous, and a kidney with minimal changes, changes insufficient for recognition by the surgeon at the operating table and requiring thorough investigation on the part of the pathologist for their detection.

Despite the preponderance of the infrarenal (ureterovesical) lesions here, we can safely adjudge the tuberculous process to have been developed in the descending sense.

If we compare the renal lesions in our cases of ascending tuberculosis with those mentioned as possibly giving rise to confusion in interpretation (as Case III), we will see, on the one hand, that in Cases I and II there was a tuberculous pyelitis associated with

discrete and in one instance confluent miliary nodules in the parenchyma, lesions that can be correctly estimated as of recent development, while, on the other hand, the lesions present in Case III (Figs. 2 and 3) are evidently very old, as evidenced by the extensive coagulation necrosis and the reactive fibrotic condition in the immediate neighborhood.

SUMMARY. We have given clinical and pathological proof of the occurrence of cases of ascending renal tuberculosis, ascending at least in the sense that the renal and ureteral lesions are secondary to the bladder involvement; we have shown that minimal tuberculous renal lesions, when associated with extensive vesical and ureteral changes, are doubtless, in some cases, later involvements of the urinary tract, be they produced in the true ascending, canalicular sense of propagation by contiguity or in a more circuitous fashion by late embolic invasion of the kidney; and, by the results of the removal of the kidney in two of the cases, have given ample testimony of the value of nephrectomy even in this type of urinary tuberculosis. Although the renal parenchyma is practically uninvolved in some of these cases the retention of tuberculous urine in the pelvis of the kidney and the constant contamination of the bladder with tuberculous products elaborated in the ureter are sufficiently active factors in interfering with recovery.

EFFECTS OF THE INJECTION OF ATROPIN ON THE PULSE-RATE, BLOOD-PRESSURE AND BASAL METABOLISM IN CASES OF "EFFORT SYNDROME."

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INTRODUCTION. During the studies upon the "Irritable Heart of Soldiers" at U. S. Army General Hospital No. 9, it was found that a considerable percentage of the cases were responding in a characteristic way to standard injections of epinephrin,[1] while others of the group reacted no more to the drug than did a normal individual. In patients sensitive to the drug there was in each

[1] Wearn, J. T., and Sturgis, C. C.: Effects of the Injection of Epinephrin in Soldiers with "Irritable Heart." (To be published.)